

What is claimed is:

1. A reactor for processing a hazardous gas using a non-thermal plasma and a dielectric heat produced when the non-thermal plasma is produced, the reactor comprising:
- 5 a body having an inlet and an outlet;  
a plurality of planar electrodes arranged parallel in the body and spaced apart from each other at a certain interval, in which the plurality of planar electrodes are alternately connected to an alternating current power, and a ground such that every  
10 other planar electrode is connected to the alternating current power and the remaining planar electrodes are connected to the ground; and  
a power supply unit for applying a voltage of an alternating current frequency to the planar electrodes.
- 15 2. The reactor as claimed in claim 1, wherein each of the planar electrodes comprises a first dielectric plate and a second dielectric plate, a first side of each of the first and second dielectric plates being coated with a metallic thin film and a second side of each of the first and second dielectric plates being coated with a catalyst, and the first and second dielectric plates being adhered such that the  
20 metallic thin film of the first dielectric plate faces to the metallic thin film of the second dielectric plate.
3. The reactor as claimed in claim 2, wherein each of the dielectric plates has a thickness of 0.1 to 2 mm.
- 25 4. The reactor as claimed in claim 2, wherein the dielectric plate comprises any one selected from the group consisting of ceramic, glass, and quartz.
5. The reactor as claimed in claim 2, wherein the catalyst is a metallic  
30 catalyst- containing at least one metal element selected from the group consisting of Pt, Pd, V, and Rh..
6. The reactor as claimed in claim 2, wherein the catalyst is a zeolite catalyst containing at least one zeolite selected from the group consisting of MS 5A

and MS 3A.

7. The reactor as claimed in claim 2, wherein the catalyst is a photo catalyst containing  $\text{TiO}_2$ .

5

8. The reactor as claimed in claim 1, wherein the power supplied to each of the planar electrodes by the power supply unit is an alternating current voltage of 1 kV to 30 kV at a frequency of 50 Hz to 100 kHz.

10

9. The reactor as claimed in claim 1, wherein each of the planar electrodes comprises two dielectric plates, a metallic thin film interposed therebetween, and a catalyst layer coated on an outer surface of each of the dielectric plates which is opposed to an inner surface facing the metallic thin film.

15

10. The reactor as claimed in claim 9, wherein each of the dielectric plates has a thickness of 0.1 to 2 mm.

20

11. The reactor as claimed in claim 9, wherein the dielectric plate comprises any one selected from the group consisting of ceramic, glass, and quartz.

12. The reactor as claimed in claim 9, wherein the catalyst is a metallic catalyst- containing at least one metal element selected from the group consisting of Pt, Pd, V, and Rh..

25

13. The reactor as claimed in claim 9, wherein the catalyst is a zeolite catalyst containing at least one zeolite selected from the group consisting of MS 5A and MS 3A.

30

14. The reactor as claimed in claim 9, wherein the catalyst is a photo catalyst containing  $\text{TiO}_2$ .

15. A method for processing a hazardous gas, the method comprising:  
installing a plurality of planar electrodes parallel in a reactor, each of planar electrode comprising two dielectric plates, each of the dielectric plates including a

catalyst layer coated on an outer surface thereof, and the plurality of planar electrodes being alternately connected to an alternating current power and a ground; applying an alternating current voltage of an alternating current frequency to the planar electrodes to produce a non-thermal plasma and a dielectric heat; supplying the hazardous gas into the reactor; and carrying out a plasma reaction and a catalysis reaction on the hazardous gas to cause a decomposition of the hazardous gas.

16. The method as claimed in claim 15, further comprising periodically supplying a pure air and oxygen into the reactor for removing a by-product of liquid and solid forms produced in the reactor.

17. The method as claimed in claim 15, wherein the hazardous gas is at least any volatile organic compound selected from the group consisting of perfluoro-compounds, chlorofluorocarbons, trichloroethylene, dioxin, and nitrogen oxides.